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This study sought to identify physical facilities needed to connect the six New England land-grant universities. Criteria were time (use of current technology), cost (regular operating budgets of participating institutions), minimal personnel requirements, flexibility, and compatibility. The telephone system, an existing microwave network, a developing radio network, and computers and other communication devices received special attention. It was suggested, among other things, that the Eastern Educational Television Network (EEN) could be the backbone of an educational information network, and that a main truck microwave relay system from Washington, D.C., to Montreal could be created to serve a complete regional distribution system. (The document includes provisions of the Higher Education Act, Title 3; EEN associated institutions; and descriptions of the EEN itself, the New England Library Information Network, a shared data processing system for Vermont hospitals, the proposed Agricultural Network of the National Agricultural Library, the proposed University Information Technology Corporation involving Harvard and the Massachusetts Institute of Technology, and information and computer utilities.) (ly)

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A New England Land-Grant Network

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The New England Center for Continuing Education

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A New England Land-Grant Network

A study of the feasibility of establishing educational information links between the six land-grant universities in New England

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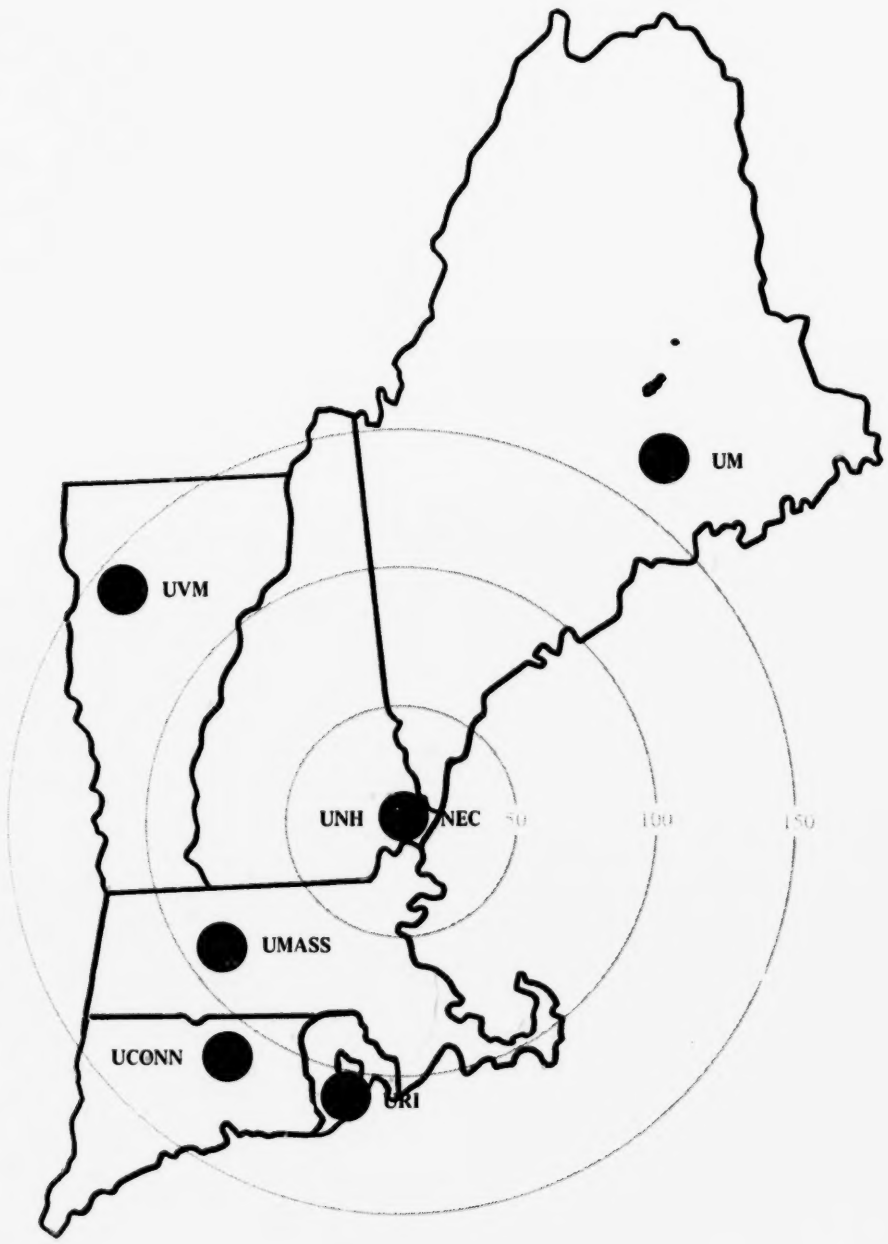
Figure 1: The New England Region



Introduction

The information explosion makes the management of data an overwhelming problem for the average state university. This is especially true in New England, where six distinct universities must meet the needs of a population that is growing more and more homogeneous. (Readers are probably familiar with the concept of "Boswash" — a super-city extending from Boston to Washington. Less familiar and more sobering is the fact that planners are now speaking of "Portport" — Portland, Maine, to Portsmouth, Virginia. Vermont will be the only New England state not incorporated in this great megalopolis.)

Compounding this difficulty is the fact that none of the New England state universities is "big" by contemporary standards. Indeed, four of them are quite small.

On the other hand, of course, each of the six universities has tremendous information potential in several areas. and each has developed computer facilities, media services, and cadres of highly trained personnel. More significant, each university has made some progress toward sharing its potential with the other institutions. For example: the Eastern Educational Television Network has established microwave links in most of the New England states, and others are planned; an Eastern Educational Radio Network is now under development; and, through the New England Library Information Network, the university libraries are jointly cataloging their collections.

In an effort to measure the region's information-sharing potential, the New England Center for Continuing Education has conducted a survey of current projects and facilities.[1] From the

[1]The survey was made possible by a grant from the Educational Facilities Laboratories, Inc., of New York.

beginning, the study was conducted with an eye toward developing a comprehensive, regional information network. The detailed results are set forth in Part II and Part III of this report. Part I is concerned with the mechanics of the study, a summary of its findings, and their implications for the establishment of a New England Land-Grant Network.

Part I

The Network: Present and Future

Some Notes on Methodology

The effectiveness of the New England Center as a catalyst for the study of regional problems will depend in large part upon the ready availability of appropriate information — for conference planners, for conferees, and for the "consumers" of programs fostered by the Center. Accordingly, this system is being designed to satisfy the information needs of six specific institutions in a particular region, and the emphasis is upon programs of continuing education. Although other regional information networks may be developed along similar lines, the results of this study must be interpreted within the framework of the situation that inspired it.

Assumptions

a) The "information explosion" becomes more manageable when a group of institutions divide the responsibility for data-banking, so that each institution can focus on a particular subject or area of concern.

b) The continuing education of professional people is more closely related to providing them with information than to organizing conventional instructional programs.

c) It is possible to link institutions so that each can have input-output capability at stations on its campus.

d) The information system can support planning and conference activity at the New England Center, can be made available to other institutions (hospital, libraries, private colleges, and the like), and can be linked with other information networks currently under development.

e) The system will operate 24 hours a day, 365 days a year.

f) The transmitted messages may be human voice, still pictures, numerical data, teletypewriter messages, or remotely controlled stylus.

g) Messages may involve one "transmitter" (speaker) and one "receiver" (listener), one to a few, one to many, a few to one, a few to a few, or many to many. Communication may be in one direction only or in both directions.

h) Messages may be of any duration to a maximum of perhaps two hours. They may occur at regular intervals or irregularly, frequently or infrequently.

i) Messages may be recorded for future use.

Deliminations

a) This study was concerned with identifying the physical facilities needed to link six campuses for the transmission of educational information.

b) There was no intention to become involved with the selection and programming of the information.

c) The objective of such a system is to provide information that will change human behavior. However, the investigator was not concerned with the effectiveness of this information in changing behavior or whether the information is ever used. The study was concerned only with proposing a linkage system that will make the information available.

d) Consideration was given to the electronic equipment now available on each campus, but the system will not necessarily be designed to accommodate it. Nor was the investigator seeking a single, integrated, "all-purpose" system. It is possible that linkage may eventually be achieved by the interconnection of several independent systems, coordinated to provide different types of access to information.

Criteria of Feasibility

a) *Time*: The intent is to develop a system that will utilize current technology. An existing microwave network, the telephone system, a developing radio network, and communications devices at the universities therefore received special attention in the study.

b) *Cost*: The service and maintenance costs of the system will be financed from the regular operating budgets of the participating institutions. Economic feasibility will ultimately be determined by the New England Council for Continuing Education, which includes the six university presidents and their representatives.

c) *Personnel*: The proposed system will require minimal additions to the technical staff and maximum use of the shared

services of existing staff members at each of the institutions.

d) *Flexibility*: Components can be added, removed, or changed to improve the efficiency of the system or to satisfy future needs.

e) *Compatibility*: The system will minimize problems of compatibility and maximize components that lend themselves to adaptibility.

Procedures

a) The investigator surveyed the literature to determine the types of links that have been established or are being planned.

b) A high-level advisory panel was established to advise and consult with the investigator during the survey period.

c) The investigator visited areas where links have been created and interviewed experts who have conducted specialized investigations relating to the linking problem.

d) He visited each campus supporting the New England Center to determine the nature of the equipment to be linked, and the qualifications of available technical personnel.

e) He determined the technological sophistication of the existing links among the six institutions.

f) Based on the data collected, the investigator and the advisory board will make recommendations on the most appropriate method (or methods) of linking. These recommendations will then be available to any consulting agency that might be hired to do the comprehensive technical engineering studies that will be required.

Summary of the Study

The Eastern Educational Television Network (the only line, interstate educational television network in the United States) could be the backbone of an educational information network to serve the New England Region. The EEN has proposed the construction of an independent interconnection system by microwave relay that would consist of a main trunk relay system from Washington, D.C., to Montreal. It would become the backbone of a complete regional distribution system. State-financed networks in existence and in the planning stages would then connect to this interstate system, expanding the service to the entire region.

There is good reason to expect that national information networks will evolve from state and regional systems developed to meet specific needs of certain professional groups in that area. At

the present time, Roger Hodgkins in Maine, Richard de Grasse in Vermont, John Bardwell in New Hampshire, and Walter Gray in Rhode Island are investigating the feasibility of expanding information services in those states. Through the offices of the New England Center they are able to share their experiences and pave the way for the physical interconnection of information systems if their studies support the need for sharing resources in this manner.

Maine

President Young of the University of Maine, requested that Mr. Hodgkins study the feasibility of sharing library resources, developing a state FM radio network, and sharing computer services among the three campuses at Orono, Portland, and Augusta, as well as the five state colleges.

Mr. Hodgkins has determined that an independent system, owned and operated by the university, could share transmitter sites now owned by the state ETV network. Using business services frequency assignments, a party line between Orono, Augusta, and Portland could have a two-way flow of information on a microwave system on a base band of 8-10 megacycles. Such a system would have the following capability:

a) 5 megacycle TV video channel
b) 15 KC TV audio channel
c) 15 KC radio FM channel
d) 15 KC channel for data
e) 15 KC Channel for voice and/or teletype

Faculty conferences have been held with a video signal originating from Orono and with audio talk back from Portland.

At the University of Maine at Portland, a 2500 MHz TV system has been activated and is being used to bring medical reports to the Maine Medical Center on an experimental basis. Meetings have been held with representatives of the Maine Hospital Association to explore computer interconnections for improved medical services.

Future plans to explore extending the information system to the five state colleges are being developed and institutional requirements are being explored.

Vermont

The Regional Medical Program has developed two programs which require an examination of state and regional information systems. Dr. George Welsh is concerned with programs of continuing education for people in the allied health fields, and

Richard de Grasse is planning to improve medical services through the development of more efficient information systems. Mr. de Grasse is developing a system to facilitate emergency medical treatment and is conducting a feasibility study for a hospital shared data processing system for the state of Vermont. The study will consider potential interface with similar systems in Maine, New Hampshire, and New York.

New Hampshire

President McConnell of the University of New Hampshire has authorized John Bardwell to study the feasibility of establishing an information link between the University campus at Durham and the state colleges at Plymouth and Keene. Linkage with a branch in Manchester will be included in the study. The establishment of microwave links using existing sites is being explored. The system would have the same capabilities planned for the Maine system, and the two projects are being conducted with careful coordination by the project directors.

A two-way microwave circuit has been proposed to interconnect hospitals in Lebanon, Hanover, Claremont, Woodsville, and Littleton, New Hampshire, and Springfield, Vermont. Since December 1968 an experimental system interconnecting Hanover and Claremont has been used for remote psychiatric consultation. Under the direction of Dr. Robert Weiss, Professor of Psychiatry at Dartmouth, the telephone company has bridged the 26 miles with a microwave system that provides two-way video signals. Land lines provide two-way audio and one-way remote camera controls that are operated from Hanover.

Donald Vincent, Librarian for the University of New Hampshire, has been active in the development of NELINET, a cooperative cataloging project involving the six New England state universities. He is involved with plans for a state TWX system, information services for Plymouth and Keene State Colleges, and a cooperative cataloging project with five small colleges.

Massachusetts

Albert Hulsen is the station manager for WFCR, a five college educational radio network that is located at the University of Massachusetts in Amherst. The station is operated by the Western Massachusetts Broadcast Council. Mount Holyoke, Amherst, Smith, University of Massachusetts, and Hampshire College are linked by microwave and telephone lines. In addition, WFCR is interconnected to the Eastern Educational Radio Network

through WGBH in Boston and WAMC in Albany.

WGBH is the hub of the ETV activity in Massachusetts, but the only microwave system is the Boston-Georgetown-Durham link which is owned by the State of Maine. Two-way circuits are being proposed between Boston and the following points:

a) Amherst (Mass.) and Albany (N.Y.)
b) Brown University in Providence (R.I.)
c) Yale University in New Haven (Conn.)
d) Tanglewood (a one-way circuit from the Boston-Amherst link)

Since June 1968, Dr. Kenneth T. Bird of the Massachusetts General Hospital has been experimenting with diagnosing illness over television. He has turned the Logan International Airport Medical Station into a television studio and, three miles away, has turned a small emergency ward at the hospital into a television control study. In the first year of a three-year pilot program, it is hoped that a telediagnosis network might be developed. The 12,500-Hz two-way microwave system was designed by Richard Oldham, Assistant Director of the Educational Division of WGBH. The system was installed by Raytheon Company for black-and-white TV transmission.

Rhode Island

The major information system in Rhode Island is a TWX system that has been funded by the Department of State Library Services since 1967. The network links the Regional Library Centers, the Principal Public Library, and the three Special Research Centers:

a) *Regional Library Centers* — Pawtucket Public Library, Barrington Public Library, Warwick Public Library, and Westerly Public Library

b) *Principal Public Library* — Providence Public Library

c) *Special Research Centers* — Brown University, Rhode Island College, and University of Rhode Island

The TWX connection at the Principal Public Library (connecting with Connecticut, Maine, and Vermont, with Massachusetts soon to join) is funded for Providence from its grants from DSLS.

Connecticut

A TWX (or TWP) system for interlibrary loan links the University of Connecticut, Yale, Trinity, Wesleyan, and Connecticut College with public libraries in Greenwich, Stamford, Nor-

wich, Hartford, and Bridgeport. The control center is at the State Library in Hartford. United Aircraft conducted a study of the feasibility of developing an instate network for library services with the support of the State Library.

A NASA Information Center has been organized in the School of Business Administration at the University of Connecticut and has reportedly established a computer network to disseminate NASA research to business and industry. There are approximately 250,000 documents available.

An extensive microwave and cable network, leased from the telephone company, interconnects Storrs with branches in Stamford, Waterbury, Torrington, and Hartford. There is a connection with WTIC in Hartford, and it will be connected to the Avery Point branch in Groton in the near future. In two or three years the Farmington Health Center will be connected to other hospitals and the University of Connecticut system. The medical link is planned for two-way color transmission. The present system is one-way but may be converted to a two-way system in two or three years.

The University Computer Center has expanded its capacity and plans to accommodate up to 30 remote terminals. Five or more of these will be located in the branches and linked by telephone lines to the computer at Storrs. Thus a computer network has been established and may be expanded to include not only the University branches and professional schools but also other educational institutions in the state.

Conclusions and Recommendations

Conclusions

This summary of information systems and subsystems reflects the experience of the principal investigator during the twelve-month period in which he visited all six states and interviewed hundreds of people. A recent news article indicating the establishment of a TWX system in Maine for inter-library loan is an indication that many additional information systems were overlooked or have been developed during the past few months. The following statements are based on the assumption that the catalog of systems identified in this report is adequate support for those conclusions.

The need for comprehensive educational information networks has been firmly established by the number of sub-systems

that have been identified in this study. The need to share library and computer resources has stimulated the growth of TWX systems within many states. The need to share the burdens of program production has led to the development of extensive TV microwave networks and off-air radio networks. The allied health fields have many urgent information needs.

The software is accumulating rapidly as computer tapes, audio tapes, video tapes, and books are acquired or developed by the great universities. Patient data can be accumulated by hospitals and doctors but the information is rarely avialable for emergency treatment. The resources are vast, but access to the resources is extremely limited.

The hardware is being acquired nearly as rapidly as the software. Elaborate ETV studios, modern computer centers, teletypewriters, and similar types of electronic equipment are present on all the university campuses. Extensive microwave facilities exist in four of the six states. Utilization of sites, buildings, and towers for an information system could minimize the costs of installing the new system and provide additional financial support for the operation of the old system.

The personnel for such a system might be supplied, in part, from the pool of existing engineers, program managers, and educators that operate the existing subsystems. TWX systems in libraries, microwave facilities, radio and television studios, and computer centers provide the personnel to operate an unusual number of subsystems and could continue to function in similar roles if a comprehensive transmission system were established.

Recommendations

The problem of developing a comprehensive information system is extremely complex because of the many agencies and individuals who are involved in the subsystems that are operating, under development, or under consideration. The problem is further complicated by state and federal regulations which apply to interconnections between states. There is need for coordination of the representatives from each of the six states who are responsible for coordinating the planning within each state. Therefore, I would submit the following recommendations for consideration:

a) The New England Center should become the catalytic agency to coordinate the planning of New England educational information systems.

b) Each of the six state universities should designate an

"Information Systems Specialist" whose responsibility will be to coordinate the planning for state and regional information systems.

c) Information Systems Associates should be appointed by organizations representing hospitals, ETV, educational radio, public libraries, state and university libraries, computer centers, and other potential users of a comprehensive system. These associates would represent their professions on task-forces established to study the problems and make recommendations. The State Information Systems Specialists would coordinate their activities and provide liaison with the other state groups through the offices of the New England Center.

Once appropriate people have been identified, State Information Specialists could meet with the associates to plan the organization of activities within each state. Representatives from EDUCOM, EEN, and other agencies would provide consultation and guidance.

One role of the State Specialists could be to identify information needs and establish task forces to explore the various aspects of these needs. They could also constitute a coordinating body to help insure that state programs are compatible with regional needs. The New England Center could coordinate the planning of studies, assist with the development of proposals for funds, and facilitate the dissemination of appropriate information.

Areas where additional information is obviously needed:

a) What are the costs of piggy-backing on existing services as compared to establishing a new comprehensive system? What kinds of information will be involved?

b) What additional personnel will be required and how will they be trained?

c) How is the system to be managed and where will the control center be located?

d) What are the legal problems of establishing interstate and intrastate transmission systems?

e) What types of spaces must be designed to send and receive information? Where should they be located?

f) How will such a system change the role of existing libraries, computer centers, ETV studios, and other information agencies?

g) How do we arrange for other agencies (hospitals, private colleges, public schools, etc.) to use the system? How do we charge for such services?

A review of the literature in the information sciences reveals a serious lack of research information about the needs of the people who use educational information systems. One researcher suggests that it is probably unrealistic to expect that information users can be educated to use that which is available to them; we should assume that they are "incurably apathetic" toward present services. He believes that the services should be changed, not the patrons.

Part II
Survey of Current Projects

New England Library Information Network

This project was initiated by the librarians of the six New England state universities. The libraries of five New England state universities now constitute the operating and testing environment within which project research and demonstrations are being carried out. Following this stage of development, the plan of operation includes provision for services to as many as ten times that number of comparable libraries.

The Council on Library Resources has provided the initial support for the developmental stages of the project by a series of grants to the New England Board of Higher Education, which has acted as official sponsor. The Board will assume responsibility for the necessary continuation of the project until permanent operation of the information network can be established by the participating institutions and libraries. The function of the New England Regional Processing Center is to provide library technical processing services to the participating libraries. These services will include: catalog data file creation and maintenance, catalog data file search and retrieval, production of catalog card sets, production of book labels, production of book pockets, acquisitions control, bibliographical searching, and production of union catalogs of regional resources.

Although the services listed above are the only ones that have been planned thus far, the services that the regional center might eventually provide need not be restricted to these but might extend to any of the following: production of accessions lists, production of book catalogs, production of serial holdings lists, circulation control, serial records control, and maintenance of subject and other authority files.

The computer will be used as a tool to provide processing services, but, equally important, it will be a conduit for current

cataloging information in machine form produced by the Library of Congress MARC project.

This project has a system design of scheduled growth, under which a succession of service functions are to be programmed, tested, and placed in operation. Three tasks have been defined which comprise the systems and programming work required to implement the system:

Task 1: Catalog data file creation.
Task 2: Catalog data file searching.
Task 3: Acquisitions processing.

Task 1 System: Catalog Data File Creation

The function performed by Task 1 of this experiment was to develop programs to create a file of catalog data in machine readable form. The creation of this file is a by-product of the individual library's normal operation, such as processing new acquisitions for the library. A second source is Project MARC. A third source is catalog data from any reclassification project contemplated or underway in any of the libraries.

Services Provided by Task 1 Programs: The services to the libraries provided by Task 1 programs are the production of catalog card sets, labels for book spines, and labels for book pockets. Catalog card sets are printed on standard rag stock in upper and lower case. In addition to building the catalog data file, this provides immediately useful products for new cataloging and reclassification. When other libraries process the same title, additional card sets can be produced. All card sets are produced complete with overtyped headings ready for filing.

Book labels are produced automatically on a tape typewriter using a Selin platen. Special labeling in addition to the call number are derived from copy number and book location information which is provided with the catalog copy. The computer types the copy number and location information in the proper format on the label.

Book pockets are labeled using pressure sensitive adhesive labels. This service is optional so that libraries that do not need printed pockets will not receive them.

Task 2 System: Catalog Data File Searching

Task 2 consists of the development of techniques and programs to permit searching of the master file by elements other than the L.C. card number and by various combinational elements. The objective is to search in support of cataloging, and the

search techniques and programs are optimal with respect to three somewhat opposing objectives: high probability of matching when unimportant variations occur between question and file, low probability of multiple selection when similar bibliographic elements occur for different titles in the file, and small storage requirements with low running time. The program is designed for an off-line teletypewriter based system, although the techniques developed are also applicable to any future display terminal system operating on-line.

Task 3 System: Aquisitions, Search, and Control

In Task 3 the catalog search capability is expanded to support acquisitions. In order to support acquisitions search, a large part of the library's complete catalog must be encoded into the catalog data file so that searches can be made against current holdings. This requirement is satisfied by storing MARC II catalog data, encoding current acquisitions, and entries from any reclassification process.

The basic requirement of acquisitions searching is the capability for rapid back and forth communication or dialogue between the acquisitions searcher and the system. This capability is needed to locate the proper descriptive data about a book, given incomplete information. This requirement is satisfied by storing the catalog data in a random access file, instead of magnetic tape, and linking the libraries to a time-shared random access file by a typewriter keyboard.

The primary difference between searching in Task 2 and Task 3 is that in Task 3 the searcher has immediate access to the catalog whereas in Task 2 the searcher has to wait for a batch processing on magnetic tape. This rapid access capability allows a dialogue between the catalog and the searcher, so that the searcher can immediately refine his question if an inquiry fails.

Task 4: Initial Use of Teletype Network and Demonstration of Programs and Services

Task 4 tested and demonstrated the programs and services of Tasks 1 and 2 in an environment that simulated many of the features and problems of the later on-line time-shared system. Remote teletypes were installed in each of the six participating libraries and were connected via dataphone to a teletype at the central computer in Cambridge.

During the Task 4 period, all the programs for the file creation, technical processing, and catalog data file searching were

used and refined on the basis of this use. Communications procedures were checked out, an evaluation of the products and services of the system were made, and the time and usage studies were made to enable a smooth transition to the later on-line system.

The Future New England Library Information Network

The transition to an on-line time-shared system was scheduled for July 1968. This transition is still an objective but it has not yet been realized. The first on-line system would provide a full service center for technical processing and acquisitions. A mass storage system and a more powerful time-sharing computer would take the place of the off-line magnetic tape system used in the Task 4 system. The effective operation of the cooperative center will depend on having fast access to a sizable data base, and the planned transition will provide this means. The overall plan has been to develop a full repertoire of programs, formats, communication techniques, and methods on an inexpensive magnetic tape system, and then switch over quickly to a full service system. The economic objective is to minimize the initial non-productive set-up time on the on-line system.

Once the on-line system is in operation, plans for expanding the network and its services will be formulated. As the five participating state university libraries develop their own computer facilities, it is reasonable to expect that they will become subcenters of library networks within their states. In addition, plans are being made to service an initial cadre of 24 other libraries of comparable dimensions. Decentralization of this sort will minimize communications costs and optimize the use of faclities. It is probable that improved on-line terminals, incorporating display capability, can soon be added inexpensively at the libraries permitting a greatly expanded search capability.

As the Library of Congress MARC services expand, these will be incorporated into the system. The early operation of the library network is expected to provide much data of value in determining the design, operation, and costs of other regional library networks, national library networks, and general machine-aided remote access to information resources.

Eastern Educational Network, Inc.

The Eastern Educational Network is a regional cooperative educational television network, organized to heighten the quality and increase the quantity of its members' programming. The

Figure 2: Proposed EEN Interconnection

Station	Channel	City	Service Area
WETA-TV	Ch. 26	Washington, D.C.	Metro Washington
WHYY-TV	Ch. 12	Philadelphia, Pa.	Metro Philadelphia
WQED-TV	Ch. 13	Pittsburgh, Pa.	Metro Pittsburgh
WNDT-TV	Ch. 13	New York, N.Y.	Metro New York
WMHT-TV	Ch. 17	Schenectady, N.Y.	Schen.-Albany-Troy
WNED-TV	Ch. 17	Buffalo, N.Y.	Metro Buffalo
WEDH-TV	Ch. 24	Hartford, Conn.	Central Conn.
WGBH-TV	Ch. 2	Boston, Mass.	Eastern Mass., R.I.
WCBB-TV	Ch. 10	Augusta, Maine	Southern Maine
WMEB-TV	Ch. 12	Orono, Maine	Central Maine
WMEM-TV	Ch. 10	Presque Isle, Maine	Northern Maine
WMED-TV	Ch. 13	Calais, Maine	Eastern Maine
WENH-TV	Ch. 11	Durham, N.H.	Southeastern N.H.
WEBD-TV	Ch. 40	Berlin, N.H.	Northern N.H.
WLED-TV	Ch. 49	Littleton, N.H.	Northern N.H.
WHED-TV	Ch. 15	Hanover, N.H.	Central N.H.
WEKW-TV	Ch. 52	Keene, N.H.	Southeastern N.H.
WETK-TV	Ch. 33	Burlington, Vt.	Northwestern Vt.
WVTB-TV	Ch. 20	St. Johnsbury, Vt.	Northeastern Vt.
WVER-TV	Ch. 28	Rutland, Vt.	Southwestern Vt.
WVTA-TV	Ch. 41	Windsor, Vt.	Southeastern Vt.

EEN's affiliated educational stations in the Northeast stretch from Washington, D.C., to Maine, and westward to the Ohio border.

The Eastern Educational Network is an independent nonprofit charitable corporation, chartered in 1960. In addition to the stations listed on page 22, its membership includes two production centers, the Philadelphia Public Schools and the Twenty-One Inch Classroom of Boston; one area developing ETV facilities (the University of Vermont); seven State Departments of Education (Maine, Vermont, Massachusetts, Rhode Island, Connecticut, New York, and Pennsylvania); and two national networks (National Educational Television and the Canadian Broadcasting Corporation).

The members financially support the Network by means of annual assessments which range from $150 to $3,500, depending upon the class of membership. An additional assessment for additional staff brings the present annual ETV station charge to $5,000. Members also support the Network by making available to it their best programming, free of charge.

The powers of the Corporation reside in a Board of Trustees, composed of and elected annually by the members. A small administrative and programming staff directs its activities from the EEN office in Boston.

EEN Activities

Programming: The distribution of instructional and adult programming from four sources: EEN members, outside services, cooperative production among members, and EEN Network production.

Interconnection: The creation of an interconnection system to all member stations and state networks in order to carry out program exchange and generation.

Activation: Consultation and support in the development of new educational stations and state networks within the region.

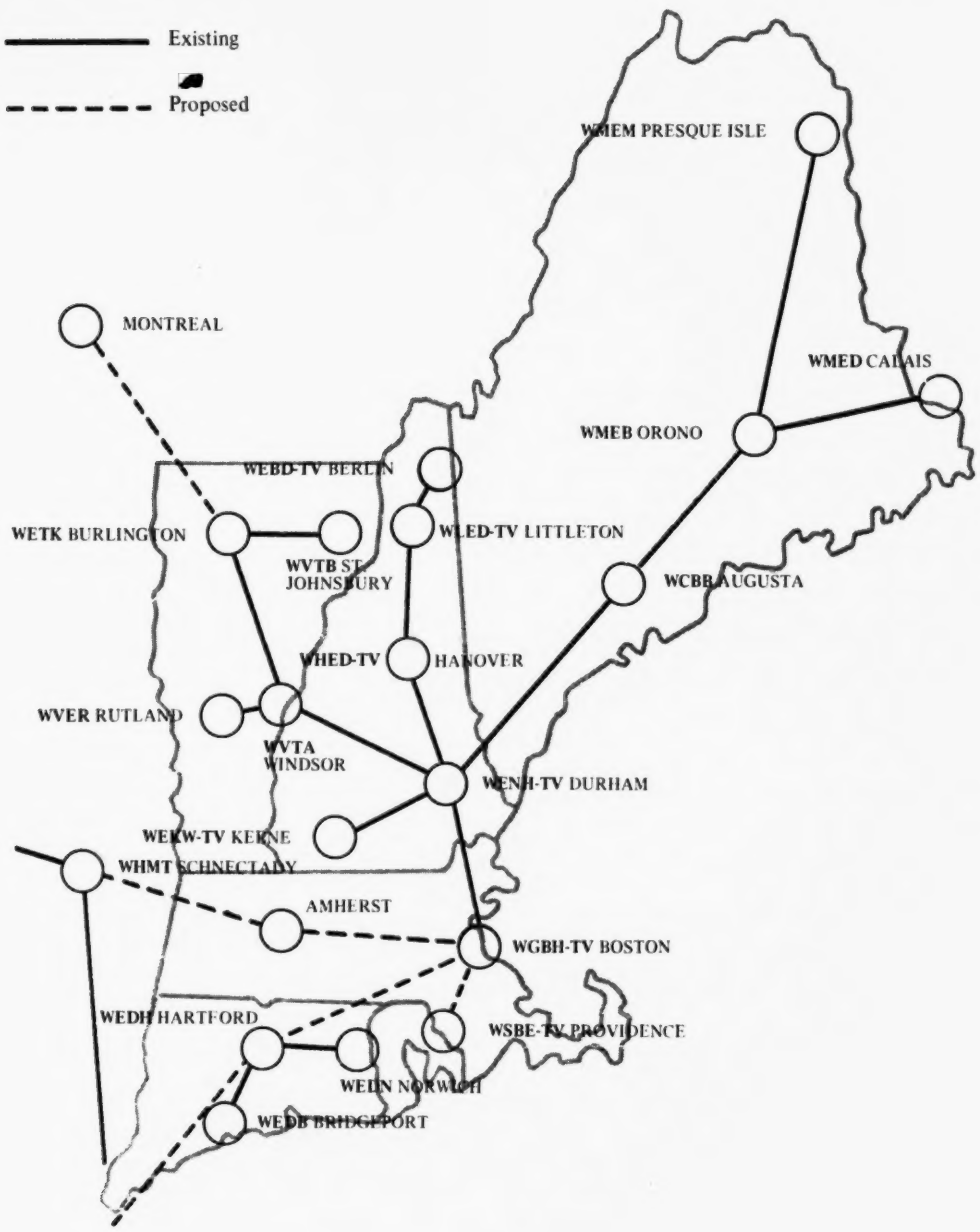
Consultant Services: Workshops, meetings, and consultation in production, administration, engineering, and public relations to further the improvement of personnel and facilities.

Research: Research and the demonstration of regional cooperation in the field of instructional television through EEN's Center for Instructional Television.

Distribution

Programs are distributed simultaneously to seven EEN members: New York City, Schenectady, Boston, Durham, Augusta,

Figure 3: ETV Microwave Network



Orono, and Presque Isle; and by recorded means to Washington, Philadelphia, Pittsburgh, Buffalo, and Hartford. The simultaneous distribution is made possible by off-air pickup, private microwave, and leased facilities. The recorded distribution is accomplished by videotape recordings shipped via the mail.

Microwave System in New England

Raytheon Corporation installed all the microwave equipment used by educational and commercial television stations in New England with the exception of a system installed between Mount Washington and Lewiston, Maine. This was installed by RCA for WCBB, and the two points are about 75 miles apart.

Maine

Most of the Maine ETV microwave system is one-way, but a two-way system is proposed between Portland and Durham, N.H. Maine owns the one-way system that crosses southern New Hampshire, connecting Boston and Portland. This link passes through Sanford, Maine.

A satellite receiving and sending installation is operating in Andover, Maine. As the bandwidth of existing equipment can be used in conjunction with satellites, this could be a major consideration in the location of stations to receive and send signals, using the educational satellites as proposed to the FCC by the Ford Foundation. A microwave link now exists between Andover and Portland. It is high frequency to Portland and then normal bandwidth from Portland. The Andover installation and the microwave link to Portland are owned by the American Telephone and Telegraph Company.

The ETV facilities are owned and operated by the State of Maine. The system has adequate bandwidth (10-12 megacycles) for computer communication.

New Hampshire

In the fall of 1967, the operation of four UHF stations in the New Hampshire Network made the Channel 11 signal available to the entire state. In addition, six translators are also planned. The translators, which are low power repeaters used to fill in specific shadowed areas of limited size, will be strategically located as required.

The UHF stations are connected to Channel 11's transmitter on Saddleback Mountain in Deerfield by microwave relay. The four stations, the microwave systems, and the eventual trans-

lators were made possible by capital funds from the state and federal governments.

Channel 40, WEDB, serves the Berlin area from its transmitter located on Pine Mountain in Gorham. Operating with 12,000 watts, Channel 40 provides a signal for a radius of 15-20 miles.

Channel 49, WLED, serves the Littleton area from its transmitter on Mann Hill, north of Littleton. Operating with 35,000 watts, Channel 49 provides a signal for a radius of 20-30 miles.

Channel 15, WHED, serves the Hanover area from its transmitter on Moose Mountain, about eight miles east of Hanover. With 30,000 watts of power, the signal covers an area of about 20-30 miles.

Channel 52, WEKW, serves the Keene area from its transmitter on Derry Hill in Walpole, about six miles north of Keene. Operating at 37,000 watts the Channel 52 signal covers an area of 20-30 miles.

The mileage figures are approximate. The exact signal coverage area is dependent upon terrain.

Dartmouth Psychiatric Consultation System: The Dartmouth Medical School conducted a survey to determine the feasibility of establishing a two-way microwave circuit to link hospitals in Lebanon, Claremont, Woodsville, Littleton, and Springfield, Vermont, with Hanover.

Early in December of 1968, an experimental 26-mile link was established between Hanover and Claremont. It is being used by Dr. Robert Weiss, Professor of Psychiatry at Dartmouth to do remote psychiatric consultation with a hospital in Claremont. Cameras are located at both stations with the hospital camera being controlled from the Dartmouth location. The telephone company microwave system carries two-way video signals. Land lines carry two-way audio signals and one-way remote camera controls.

This feasibility study is expected to continue for at least a year and will probably determine when and if the system will be expanded to other hospitals.

Vermont

The system, which became operative in 1967, covers approximately 97 percent of the state's population. Eight microwave systems provide two-way communication to Saddleback Mountain in New Hampshire for hookup with EEN. There is a total of

162 miles of transmission links.

The Burlington-Mt. Ascutney loop is augmented with relays on Mt. Mansfield and Mt. Pleasant. The connection to Saddleback Mountain is via relay on Mt. Kearsarge in New Hampshire. The University of Vermont operates the network with the main studio located at Essex Junction, near Burlington. The existing microwave system has adequate bandwidth (10-12 megacycles) for computer communication.

Four stations have been established to provide UHF coverage to the people of the state. They are as follows: WETK (Ch. 33) Burlington, WVTB (Ch. 20) St. Johnsbury, WVER (Ch. 28) Rutland, and WVTA (Ch. 41) Windsor.

Massachusetts

WGBH is the nub of ETV activity in Massachusetts but the only microwave system is the Boston-Georgetown-Durham link which is owned by Maine. Two-way circuits are being proposed between Boston and the following points: Amherst (Pittsfield) and Albany, Brown University in Providence, and Yale University in New Haven. A one-way circuit from Tanglewood would connect with the Boston-Amherst link.

The microwave system proposed for Massachusetts is "loaded." It has a bandwidth with the following possibilities:

a) Video (picture)
b) Audio (TV sound)
c) Two Audio channels, FM Mono and FM Stereo
d) A service channel (voice — two-way party line)
e) Six to twelve audio channels (voice — two-way private lines)

Dr. Bird at the Massachusetts General Hospital has developed a microwave system from the hospital to Logan Airport to explore the values of remote diagnosis. It is a two-way system that is remotely controlled from the hospital. WGBH, the contact for this project, has created an Educational Services Division to explore broad use of the microwave system. The division is directed by John Larson.

Connecticut

There is no state-owned microwave interconnection in this state, and the proposed connection between Boston and New Haven would be the first two-way link. A microwave network, developed by the Southern New England Telephone Company,

is leased from this public service organization to connect the branches of the University of Connecticut. This is a relatively extensive system which permits audio responses from the students in addition to straight television viewing. It has eight megacycles bandwidth and is a one-way distribution system. The student responses are on an audio frequency supplied by the telephone company. There is one studio that is linked to WTIC, a commercial station in Hartford. The link is one-way to Hartford, but technical quality of the signal is not adequate for broadcast. WTIC and WNHC New Haven broadcast programs produced in their studios by the University of Connecticut.

In summary, the studio facilities at the University of Connecticut support programming which is transmitted through Southern New England Telephone Company microwave system to all of the branches of the University of Connecticut. Any broadcast activity is conducted at the commercial stations in Hartford and New Haven. The only private microwave system that could interconnect directly with the EEN system is a circuit between WEBE (Providence) through Norwich to WEDH in Hartford.

Rhode Island

The state television station is located in facilities at Rhode Island College in Providence, and there are no links between Providence and the University of Rhode Island. A microwave link between the URI Electrical Engineering building and Raytheon Corporation in Portsmouth, R.I., enables professors in Electrical Engineering at the University of Rhode Island to conduct classes for Raytheon employees and teachers who are located across Narrangansett Bay in Portsmouth. This system was installed by Raytheon and includes two one-way audio systems. It is an eight megacycle system.

A microwave link between Providence and Boston is under consideration by WSBE-TV. The objective is to link Brown University with WGBH in Boston. Kingston could be connected with Boston by creating a link between Portsmouth (Raytheon Plant) and WSBE in Providence.

Summary

The microwave systems in Maine, New Hampshire, and Vermont now have adequate bandwidth (10-12 megacycles) for computer communication and it is anticipated that the bandwidth requirement for computer use will be reduced in the near future.

Computer communication now requires the full bandwidth and would be feasible only during TV downtime, when everything else is switched off. If downtime is inadequate, additional circuits can be added at existing sites. The estimated cost of adding circuits would be 25 percent of the original installation costs. Duplex systems can be developed from single direction circuits by adding circulators and filters at an estimated unit cost of $500.

Bandwidth in a "loaded system" such as that proposed for the Massachusetts system usually includes the following: a video-audio band, two audio channels (FM Mono and FM Stereo), a service channel for voice communication (two-way party line), and a possible 6 to 12 audio channels (two-way private lines).

Xerox LDX facsimile transmission equipment doesn't require complete bandwidth and could use private line audio channels with appropriate filters. Electrical requirements include a 115 volt, single phase AC, conventional grounded circuit for both the scanner and the printer.

Satellite communication is a distinct possibility. It has the following characteristics:

a) It is easier to receive than to send signals.

b) The bandwidth of existing microwave equipment can be used in conjunction with satellites.

c) The Andover, Maine, installation could facilitate ETV satellite communication.

d) An Andover to Portland connection is now operated by AT&T. It is UHF to Portland and VHF from Portland.

Relay from a microwave system to private institutions can be handled in the following ways:

a) An existing CATV cable system can carry the message between the relay point and the library if a two-way system can be accommodated.

b) If no CATV system exists an institution can install its own cable and pay rental to the owners of the poles.

c) If the institution prefers not to install cable, it can lease the service from the telephone company.

d) An institution can install its own microwave equipment between the two points.

If the rental costs for two years are equivalent to the purchase price, it is probably cheaper to purchase the equipment. In any event, for a short span of two or three miles, cable is apt to be cheaper than microwave. An estimated maintenance figure of

$2,000 per hop per year for a solid state two-way microwave circuit is based on mainteanance figures for the Maine ETV system.

Multiplexing television signals is technically possible and two or three signals can be transmitted simultaneously over a network system. Thus, the network could conceivably send: more than one TV program at one time, facsmille information in color, and data from a computer source. IT & T has developed a pulse beat modulation system that would make it possible for a radio program to send coded data simultaneously with recorded music. Both multiplexing and pulse beat modulation require encoding and decoding devices to unscramble the signals.

Vermont Shared Data Processing System

A shared data process system feasibility study is being conducted by the Federal Systems Division of IBM for the hospitals of Vermont. The study is sponsored by the Northern New England Regional Medical Program (NNE/RMP), the New Hampshire-Vermont Blue Cross, and Vermont Hospital Association (VHA). The system is envisioned as a centralized facility having a capability for receiving, storing, processing, retrieving, and transmitting data and information to and from users and sources of health data and information. The study and planning effort would be limited to that system which encompasses a major hospital which has a computer facility and surrounding smaller hospitals in processing data and information. This project will attempt to justify the needs for a SDPS and, if justified, will determine the most cost-effective method involving the Vermont Medical Center located in Burlington and extending throughout the state to an optimum involvement of other hospitals within the state.

The neighboring states of New York, New Hampshire, and Maine are considering similar projects. The study must consider an actual or potential interface with these systems and a coordinating activity has been established for this purpose.

The purpose of the project will be to determine whether or not a benefit to cost ratio of an SDPS can exceed that of the present system or improvements thereto which do not involve SDPS; and, in the event that an SDPS method is determined to be most cost beneficial, to develop an optimum system.

The goal of the Regional Medical Program is to reduce morbidity and mortality and to promote the efficiency of medical

care through the voluntary regionalization of resources. One step towards this goal is to improve administrative services. This should be done in a cost-effective manner and with a mechanism to avoid obsolescence. Objectives to be achieved in reaching this goal are to reduce the cost of data processing, to reduce the time of data processing, to reduce the time of data recall, to improve the accuracy of records, and to reduce the space required for data processing and storage.

This study is to include only the hospitals in the state of Vermont. Compatability must be considered, however, with local, state, and national data processing systems. This study will cover the spectrum of medical administrative information including the following: accounting, admissions, blood bank, dieticians office, discharge, emergency suite, laboratory, nurses station, operating suite, patient billing, pharmacy, purchasing, and X-ray.

The study will also consider the appropriate interfaces with other medical care information systems.

Information and Computer Utilities

Third-generation computers are laying the foundation for a new industry, variously described as multiple-access data services, remote computer information services, or perhaps computer utilities. Such systems, now evolving on a local or regional basis, are expected to be national in operation by the 1970's.

The FCC has called for information that will enable it to determine its regulatory jurisdiction with respect to computer services provided over the nation's communications lines, formulate rules and regulations arising from a growing interface between computer systems and communication lines, and to evaluate the question of information privacy associated with data banks and remote access retrieval systems. Clearly, this inquiry poses fundamental questions, the answers to which will directly affect university and college time-sharing networks, as well as other sectors of the economy.

Michael A. Duggan, at the Whittemore School of Business and Economics at the University of New Hampshise, is undertaking a study of the policy issues of computer utility services. He is concerned with some but not all the issues posed in the FCC's inquiry. On the other hand, he is seeking to embrace areas related to but not necessarily designated by the docket. In particular, the impact of the various proposals upon the educational

community would be evaluated.

To use a few specific examples, already the communications costs of a computer information utility using common carrier communications circuits outweigh the computation costs, and make networks of users more than 100 miles apart prohibitively expensive. At the present time, due to the limitations of the equipment requirements tariffed by the communications common carriers, it is *faster* to send a reel of magnetic tape from Washington to Los Angeles by airplane than it is to transmit the data contained on the tape by present and projected common carrier communications facilities. Already educational computer utilities are offering off-time use of their systems to private persons; and private systems are being offered to educational institutions as an alternative to in-house computation centers.

Specifically, this study will:

a) Digest and summarize governmental and private party responses to the FCC, Notice of Inquiry.

b) Organize and summarize the factual evidence submitted by all parties.

1. Identify the issues which relate to the impact on the educational community in its roles both as a user and as a supplier of EDP in conjunction with communications services and facilities, with special emphasis upon those services proposed by EDUNET.
2. Identify the issues which relate to the impact upon current practices and probable future operations of the United States tele-communications and electronic data processing industries, as they would effect educational needs.
3. Identify the issues and the impact upon the future of computer utility services, with emphasis upon those furnished to the educational community from private sources, as well as those originating within the community.
4. Structure the results of the study to identify the special concerns of education with the needs for regulation, legislation, or changes thereto.

c) Present recommendations to the National Science Foundation regarding the proposals submitted by the various parties.

d) Present recommendations to the National Science Foundation regarding proposals submitted to and suggested by the President's task force to recommend a U.S. National Communications Policy.

e) Evaluate and report upon the effect that other legislative and regulatory enactments may have upon the educational use of computer utilities, with attention to: copyright revision, including the proposed National Commission; domestic satellites; public television; application of local CATV for educational uses; and effect upon privacy and security in information and computer utilities.

f) Submit these studies as appropriate directly to the FCC for its use in evaluating the various submittals.

Agricultural Network

The Interuniversity Communications Council (EDUCOM) is currently conducting a two-year study under a research grant from the National Agricultural Library in support of the development of a "National Agricultural Library Land-Grant Institution Information Network." The project is to result in the creation of a long-range network plan for strengthening agricultural information communications among land-grant universities and the National Agricultural Library (NAL). The study is being directed by Joseph Becker, Director of Information Sciences, EDUCOM, and is being conducted by Harold King, Research Associate, EDUCOM.

The NAL is modernizing its present capibilities. Along these lines, a study is being conducted by Booz Allen Associates which will result in a comprehensive plan for automation of the Library; an automated Pesticides Information Center is in its final stages of implementation; and the *Bibliography of Agriculture* is being produced with the aid of automation. The next logical step to be taken is the development and implementation of a plan to assure maximum utilization of these capabilities by the Library's users. A library communications network, with the NAL and the land-grant institutions as participants, could constitute a giant step towards this goal. The NAL has the most extensive agricultural collection in existence (1,263,000 volumes) from the Library's relation to the 68 land-grant institutions.

The EDUCOM study is being conducted in two phases. During the first phase, a number of land-grant institutions will be visited in order to survey current information exchange activities. The objective of the survey will be to develop a description of current capabilities and techniques and to determine what additional services and information might be needed from a national

network. Activity during the second phase will be directed towards the development of a system concept and the preparation of a report outlining the system configuration and the technology required to fashion a communications network for the agricultural library community.

The major benefit to be derived from this study will be the creation of a development plan which, when implemented, will significantly improve the flow of information between the National Agricultural Library and the land-grant institutions.

University Information Technology Corporation

Plans for formation of a joint non-profit corporation by Harvard University and the Massachusetts Institute of Technology to develop a system for the sharing of computers, for the televising of lectures and for the transfer of information between libraries were announced in 1968. University Information Technology Corporation (UNITEC) is the name of the new organization. President Nathan M. Pusey of Harvard is president and President Howard W. Johnson of MIT, vice president. The executive director is Carl F. J. Overhage, director of MIT's Project INTREX, a program of experiments on the use of new information technology in libraries.

Examples of the activities planned by UNITEC are:

a) The development of a closed circuit television system by which lectures, seminars, and special events at either Harvard or MIT can be seen in classrooms or residence halls of the other institution.

b) Research and experiments in teaching through the use of computers, films, and television, with educational research information to be shared by Harvard and MIT.

c) Sharing of computer facilities through data links and shared use of selected data files and computer programs.

d) Collaboration in research on information transfer between the Harvard and MIT library systems.

The new corporation will draw on work which has already been done. For example, in 1965 Harvard University installed a network of coaxial cables to provide a multi-channel distribution of computer information, television signals, and other electronic data. This system provides a communications link between lecture and concert halls, classrooms, laboratories, and other research centers at Harvard, the Harvard Business School, and the

studios of the WGBH Educational Foundation on Western Avenue in Boston.

Dr. Overhage will not for the present relinquish his responsibility for the direction of Project INTREX. This project consists of an experimental approach to designing a library for the 1970's, employing computers and various electronic and photographic techniques to make information more accessible to library users. Computer cataloging, automatic presentation of material on television screens and rapid copying are among methods now under research. MIT's Engineering Library, serving as a laboratory for the project, is undergoing extensive remodeling in order to be used for the testing of new ideas. The program is supported at a rate of over $500,000 per year by funds from public and private sources.

Part III

Survey of Existing Facilities

University of Maine

Computer Facilities

Russell Altenberger is the full time director and he has two programmers. The equipment is a 360 Model 30 IBM and peripheral storage includes two #2311 disc drives. There are no magnetic tapes, no drums and data cells. There is a space problem at the present time and it is probable that there will be additional problems in a few months when equipment may be added. There are no defiinite plans for expansion.

Ten remote terminals have been requested. However, the support equipment is not available so that remote stations could be added and space is again a serious concern. Funds are apparently not available for adding time-sharing facilities with the next generation of equipment.

The University of Maine could use remote terminals to a large computer if such facilities were available. There have been no approved plans to add a new generation of equipment, but a number of possibilities are being explored.

Additional computation facilities on campus include an IBM 1710 and an IBM 1620 digital processor in chemical engineering.

Educational Media and Instructional Materials Facilities

Castille Gentry, former director, also taught two classes and conducted faculty workshops. Support staff included a full time graphics specialist plus clerical staff. Administrative supervision is by the Dean of Education and the budget is administered by the College of Education.

The Audio-Visual Center has a film library of 3,100 prints which are rented off the campus, distributed on campus at no rental, and are listed in a film catalog.

A centralized pool of equipment is used on the campus and

the Audio-Visual Center does most of the purchasing for the institution. The Center has repair facilities and photographic facilities that emphasize still picture photography. The current production emphasis in graphics is on overhead transparencies and 35mm slides. They do some 16mm and 8mm photography, but the motion picture production is combined with graphics. The motion picture emphasis is on 8mm films and they produce a dozen or more of these films each year. There are no special facilities for film production, but the graphics laboratory is well equipped.

There is a cooperative relationship with the campus television service. The AV director participated in a year-long faculty workshop for ETV, served as a member of the advisory board for closed circuit television, and was a member of the ETV advisory committee for the state.

There are no new campus facilities being planned that will demonstrate unique applications of educational media, with the exception of the library. It is possible that there would be areas in the library that would be exemplary.

Library Facilities

James McCampbell, Librarian. The University of Maine participated in the early phases of the NELINET project, but withdrew to concentrate on the development of improved library services for the state institutions of higher education in Maine.

The library does not have a coordinator of non-book materials but there are separate audio-visual facilities at the School of Education. The only non-book materials that are circulated outside of the library are microfilm. The approximate book holdings are 475,000 volumes. The non-book materials do not include films, recordings, or tapes. The Portland branch library has some discs and microforms. There are no flat pictures, slides, or paintings.

The library has no special facilities for the projection of audio-visual materials and no equipment available for use in the library. Audio programs can be originated in the Portland library where six turntables with headphones are heavily used. There is no dial access, no carrels, and no listening rooms.

The television transmitter is on the roof of the library and cables come into the building. However, no television programs are originated or received in the library.

At the time of the interview, the direct line to Maynard, as part of the library cataloging project, was due to be installed and there were plans to have teletype connections to the computer

center with WATS lines to branches. Since the time of the interview, the University of Maine library has withdrawn from the NELINET project and joined a state teletype network which includes many of the large public libraries in the state of Maine. This project was developed by the Maine State Library and the funds for the project were obtained by that agency.

Students do not have access to a computer book catalog, but probably will have access to a union catalog that is planned when the computer network is organized. There are no immediate plans for remote access to the library from academic buildings, administrative offices, or library study carrels. Plans for special facilities include an addition which will double the library capacity. At that time, microforms, computer terminals, and non-book materials may be included, in addition to small studio type rooms for television and film production. Teaching machines may also be added in the near future.

Educational Television Facilities

John Dunlop, former director, was interviewed. An extensive staff includes a large number of engineers, graphic directors, director of engineering, director of program, four TV producer-directors, recording supervisor, and associated support staff.

The University of Maine has an extensive closed circuit system on the campus, as well as a link with the Portland branch of the University. During the past year, over 1,400 closed circuit lectures were transmitted on the Orono campus and several activities have been taken place between Orono and Portland on the closed circuit system.

The entire central campus is wired and the Maine ETV network includes 749 miles of microwave links which are two-way between Orono and Portland. The system has a band width of 10 megacycles south and 4 to 6 megacycles north. A 2,500 MHz system is now operating on the Portland campus in an attempt to reach other viewers in this heavily populated area.

There is no mobile unit available, but they own three portable TV projection units. There are three studios available on the Orono campus for broadcast production and two available on the Portland campus. All areas that are wired have input potential so that many of the classroom areas could be used to originate educational programming.

At this point, eight to ten vidicon cameras are available for the closed circuit use and two image orthicon cameras are used

for broadcast purposes. Three video tape recorders are available on the Orono campus and one is available in Portland. Two film chains are set up to use with the system.

FM Radio Facilities

The educational radio facilities at the University of Maine are located in Stevens Hall on the Orono campus. They are operated under the supervision of the speech department in the College of Liberal Arts. The interview was conducted with Mr. Banner and Mr. Henderson.

Station WMEB-FM broadcasts at 91.9 megacycles with an ERP of 380 watts to a potential audience of over 50,000 people in 24,000 homes. The facilities include a small studio and control center in room 275, Stevens Hall. Broadcast equipment includes a Gates Dualux console, two Ampex 601 tape recorders, one Ampex 300 tape console recorder-reproducer, an RCA cartridge tape recorder, two turntables, and related supporting equipment. An RCA console and two other turntables are available for standby and production. The transmitter is a GE type BT-1-A.

WHEB-FM broadcasts Monday through Friday evening from 6 p.m. to midnight with informational, general educational, and cultural programming. Using the resources of the NER network as well as the faculty and student talents on campus, the station tries to achieve a balance of programming in areas of concern not only to faculty and student listeners, but also the general listening public.

The radio station on campus is a part of the educational arm of the university and thus is a broadcast service of the University of Maine. As funding becomes available, and as the facilities of the station expand, it is foreseen that this broadcast service will grow to include the entire state as a statewide network. Broadcasts would be in stereo and would include instructional programming on all levels. FM sub-carrier facilities would be used for broadcasts to specialized audiences.

All broadcasting would involve a professional staff. The academic program will continue to use radio facilities and broadcast time where feasible.

University of New Hampshire

Computer Facilities

Richard Burrows, acting director. Mr. Burrows has a manager for operations, a senior program consultant, a systems program-

mer, and an assistant systems programmer, all of whom are full time employees. The equipment consists of an IBM 130 Model 40 and a 1620 with two additional tape drives. The peripheral storage includes three model 2311 discs and four magnetic tape drives. There are no drums or data cells. The space is currently adequate and an estimate of future space needs is being prepared.

A computer is presently available on a time-sharing basis and there are several remote stations now in operation, including one in Kingsbury Hall, the engineering building. Telephone lines are being used for the remote terminals and 31 stations could be operated simultaneously. The computer does not have an audio response unit to telephone queries.

Additional computation equipment includes key-punches and sorters which have no direct relationship to the major center except to prepare material to run at the computation center.

Working in cooperation with the University, the members of the New Hampshire College and University Council have developed a proposal for a project that will enable students at five New Hampshire colleges to learn basic computer skills. The National Science Foundataion announced in July that the proposal had been accepted and $132,000 in NSF funds have been made available for a two-year demonstration project. Father Placidus Riley, OSB, President of St. Anselm's College and of NHCUC, is the chief administrative officer of the new project while Professor Frank Huston, also of St. Anselm's, is project director. The other cooperating colleges, all members of NHCUC, are New England College, Mount St. Mary, Rivier, and Notre Dame College. The colleges will utilize the IBM 360/Model 40 computer system, located at Durham, on a time-sharing basis via remote terminals.

Educational Media and Instructional Materials Facilities

John D. Bardwell, Audio-Visual Director; Paul Spilios, Assistant Director. The Center is supported by a clerical staff of five people, a technician who supervises equipment distribution on the campus, and three student assistants. A graphics position has been proposed, but is not filled at the present time.

The director and the assistant director teach graduate and undergraduate courses in the Education Department. The Center budget is administered by the University Extension Service and Mr. Bardwell reports to the Director of University Extension. The two main sources of financial support are state funds and film

rental income, but a considerable amount of income is received from institutes and grants.

The University of New Hampshire has a film library of just over 3,000 prints. The films are rented to off-campus educators and are available at no charge for members of the University faculty. A film catalog is widely distributed. Most of the audio-visual equipment used on the campus is supplied by the Audio-Visual Center. A centralized pool is maintained, but much equipment is distributed on a long-term basis. The members of the Audio-Visual staff frequently consult on the purchases of equipment for departments, but this is not a requirement of the institution. They rarely repair equipment and concentrate mainly on routine cleaning and maintenance.

The Center does not provide still picture photographic services for the campus because a well-developed photographic unit is available in the same building. However, the staff has participated in the production of 16mm films to meet special instructional needs.

Graphic services have been provided on part-time basis, but the position is currently open and very few graphic services can be supplied. The production emphasis is on overhead transparencies. A special area is equipped for production of these materials.

There is no direct relationship to the campus television services, which are virtually nonexistent. The state ETV station is located on the campus, but it provides no instructional programs for University students.

A number of campus facilities are being planned that would provide unique applications for educational media. They include a chemistry lecture hall with a rear-projection system serving two adjacent lecture halls, a social studies center with a large lecture hall served by a single rear-projection room, the New England Center for Continuing Education which will have dial access retrieval of audio-video information and remote control cameras to record such information in conference and seminar rooms. A response laboratory is being proposed for the Whittemore School of Business which will provide for research in the use of learning materials and the collection of empirical data to support that research. Remote access is being planned in the library through the library teletype network and in the housing units at the New England Center for Continuing Education.

Library Facilities

Donald E. Vincent, Librarian. James E. Agenbroad, assistant to the librarian, is heavily involved in the computer cataloging project. In addition, the head of the Catalog Department, Helen Abbott, and the head of the Order Department, Robert C. Reed, are both involved in the plans for the project.

The library has no coordinator of non-book materials and everything is processed as if it were a book. There are separate audio-visual facilities on the campus and the only non-book materials that circulate outside of the library are through interlibrary loan or the use of discs by professors who can secure them for home loan. The book holdings in the library at the present time are approximately 435,000 volumes.

Films are occasionally purchased from library book allocations upon the recommendation of a member of a department of the university. When such purchases are made, the films are forwarded to the Audio-Visual Center for distribution. There were 3,659 discs as of June 30, 1967. All new discs are taped as they are received and 464 have been taped to date. There are approximately 4,000 microforms distributed by the library (including 2,591 cards, 429 film, and 77 fische). There are no flat pictures, slides, or paintings.

Special facilities include a well-equipped lecture room that will hold 90 to 100 people and will permit the use of films, television, and other communication devices. There are no small group rooms or individual study carrels that are wired for listening. The library does not have any projection equipment, but it is readily available from the Audio-Visual Center. Audio programs are available through individual playback units in listening rooms. Plans call for fourteen tables equipped with disc and tape playback units to provide five listening stations at each table. The main building is not wired to receive TV, but the new addition will be wired for computers and TV. Individual study carrels could be wired if necessary. Television programs do not currently originate from the library, but this would be possible in the new auditorium which is being constructed.

Data-phones are currently being used to communicate with computer and teletype installations. Students do not have access to a computer-produced union catalog, but it is definitely in the works. Plans are being made to have computer access from the library via data-phone and TWX. These two systems will be

linked in a regional network involving the five land-grant institutions in the NELINET project and a TWX system which will link the libraries in the state of New Hampshire.

Television Facilities

Keith Neighbert, Director; Al Hotaling, Acting Director; William Brady, Director of Instructional Services. The staff also includes engineers, graphic artists, programmers, TV producers, and appropriate support staff.

The closed circuit facilities are limited essentially to a link between the television studio in the Memorial Union Building and the Spaulding Life Science Building, where several lecture rooms are wired to receive studio originated programs. Coaxial cable is located in ducts on the central campus, permitting interconnection with several of the classroom buildings in that area. However, most of the buildings are not connected to this cable so it is not possible to receive TV signals in the classrooms. The university is not interconnected with other institutions on a closed circuit system but the station owns a state-wide television microwave network that gives broadcast coverage to a large percentage of the state's population. Activation of four new transmitting sites has significantly increased the coverage. The station has no mobile unit available and there are no immediate plans to acquire one. There is no use of a 2,500 Mz, but such a system has been considered for use in Manchester. Interconnection is entirely by microwave, a one-way system that might eventually be converted to a two-way system. The bandwidth is approximately eight megacycles.

Four to six video monitors are available, but they are not currently active on the campus. There is no use of television projection and no other buildings on campus can receive or originate television signals without wiring the rooms in the building and connecting to the cable that goes through the ducts on campus. There are no plans to develop individual study carrels to receive television programming.

The one major studio, located in the Memorial Union Building, has complete broadcast capabilities. Location work is done with 16mm film. Two vidicon and two image orthicon cameras are used and two Ampex video tape recorders are included in the system. The two film chains use vidicon cameras. This ETV station has been a pioneer in the development of state educational television service and emphasis has been placed on broadcast

capability with little success in developing closed-circuit presentations for use on the campus.

Radio Facilities

WUNH-FM, broadcasting on 10.3 megacycles, is a ten-watt station located in the Memorial Union building. The station is student-owned and operated with program advisors from the Department of Speech and Drama of the College of Liberal Arts. Dr. Joseph Batcheller was interviewed.

This radio station is a typical ten-watt station with inadequate operating budget and very little promise of future support. The station is licensed to the university and is operated with the assistance of a board of advisors that passes on all policy, staff selection, and budget activities. Facilities include one studio, an announce booth, a teletype room, office space, and a multi-purpose area. It is not used for a laboratory for speech classes at the present time. There have been a number of meetings to explore various ways of increasing broadcast effectiveness, but no proposals that would increase the effective range of this station. An addition to the Memorial Union Building might provide some additional space, but there is little promise of considerable increase in space in the foreseeable future.

The University of New Hampshire station would be a vital link in creating a network connecting Boston and/or Amherst with the larger station at the University of Maine in Orono. Until this link can be developed, the Orono station will continue to be isolated from other members of the radio network.

University of Massachusetts

Computer Facilities

Professor Conrad Wogrin is the Director of the Research Center and Dr. John Lee is Director of the Computation Center. Facilities include a CDC 3600, an IBM 1620, and a PDP 8. Peripheral storage includes two CDC Model 854 discs with 2.5 million characters, four CEC 604 magnetic tapes with 800 bites per inch, two CD 861 drums with 2.5 million words (eight characters per word). This equipment does not accommodate data cells. Current space is inadequate, but there are definite plans for additional space. Sixty-four high speed teletype terminals are available to be located all over the campus and in several areas off campus.

The staff plans to establish a network operation which could service operate up to 128 remote terminals simultaneously. The

system does have an audio response unit and could be available for use by other institutions in New England from remote terminals.

Additional campus facilities include a computer for administrative use and one which is used for research in computer science. Computer facilities are being considered for the library in the new graduate research center, which will be constructed soon.

Educational Media and Instructional Materials Facilities

Raymond Wyman, Director, has a staff made up of three graphic artists, a photographer, three television technicians, a staff assistant, three electronic technicians, and several full-time instructional personnel. It is a relatively large department when compared to those in the other New England state universities. The unit is administered through the Dean of the School of Education but the budget is handled by the provost. This makes it possible for the program to be conducted on a university-wide basis. The staff offers graduate and undergraduate courses, with a non-credit offering to the elementary education block program. There is a Master's program and a CAGS program.

A film library of 1,200 prints is distributed without charge to campus and off-campus users. A special collection of 200 prints and 25 titles were bought by the new Dean of the School of Education who had them developed when he was at Stanford University. These titles are rented and sold to other colleges and universities. They print a film catalog, supply most of the audio visual equipment used on the campus, maintain a centralized pool of equipment, consult on the purchases for new equipment, and repair most of the equipment used on campus.

A photographic unit features still picture production for instructional purposes. Other photographic units on campus produce materials for public relations and other types of non-instructional programs. There is practically no 16mm film production at the present time and a moderate amount of 8mm film production.

A TV studio has been developed and graphic services are provided for the entire campus. The emphasis in graphics is over-head transparencies and 2x2 slides. Three staff members have a work room, copy room, and dark room in which they produce these materials.

There is no direct relationship between the Audio Visual Center and the TV broadcast facility that is being proposed for the

campus. However, the director is responsible for a closed circuit television system in the education complex which interconnects a variety of elementary classrooms in that building with classrooms in other buildings in the town of Amherst. The Secretary of the University is responsible for the development of a state ETV broadcast system which is still in the planning stages.

Remote computer terminals are being located on the campus. A TV link has been established to the Amherst-Pelham Regional High School which will have three coaxial cables and terminal facilities at the School of Education.

Library Facilities

David Clay, Acting Director of Libraries. Morris Schertz, Associate Director for Technical Processes, was interviewed. This library has approximately 700,000 holdings including documents and microfilms. Of this number about 515,000 are books. There is no coordinator of non-book materials because there are separate audio-visual facilities on the campus and non-book materials are not circulated outside the library. It has no tapes but there are approximately 2,000 discs and 43,000 microforms, including 13,000 micro-reels. There is no picture, slide, or painting collection.

Special facilities include a micro-film reader-printer but there are no projection facilities, projection equipment, audio equipment, carrels, or listening rooms available to the students. The building is not wired for TV, so there has been no TV origination or reception in the facility.

A TWX system with a data phone has been installed and is connected to Inforonics in Maynard, as part of the NELINET project. The students have access to a serials and journals list which is a computer-produced document. No additional computer access is planned, although there is a possibility of inter-connection with academic buildings in the near future. There are plans to provide the services of a systems analyst to study the applications of a computer in the University of Massachusetts library system.

A new graduate research center is being planned to include extensive library facilities. This building would house computer hardware and support staff. It would be completely wired for linkage with other parts of campus or other campuses. It is possible that this facility will have electronic carrels and an auditorium on the top floor that will permit the use of communications devices. When this new library is open the current Goodell Li-

brary will be renovated and it is possible that media facilities will be introduced at this time. The new building is currently in the early planning stages but there has been a definite move to set aside considerable space in this facility for computing equipment that would be devoted primarily to library use. If this becomes a reality the University will be in a position to exert leadership in library methods and computer cataloging.

Educational Television Facilities

Roger Lively, Director. The staff includes two full-time engineers and five to ten students who are used in production. A third engineer and a graphic artist have been proposed. One of several television production areas that have been developed at the University of Massachusetts, this particular system is located in the School of Education. The Secretary of the University is responsible for directing the development of the proposed statewide system which is still in the planning stages.

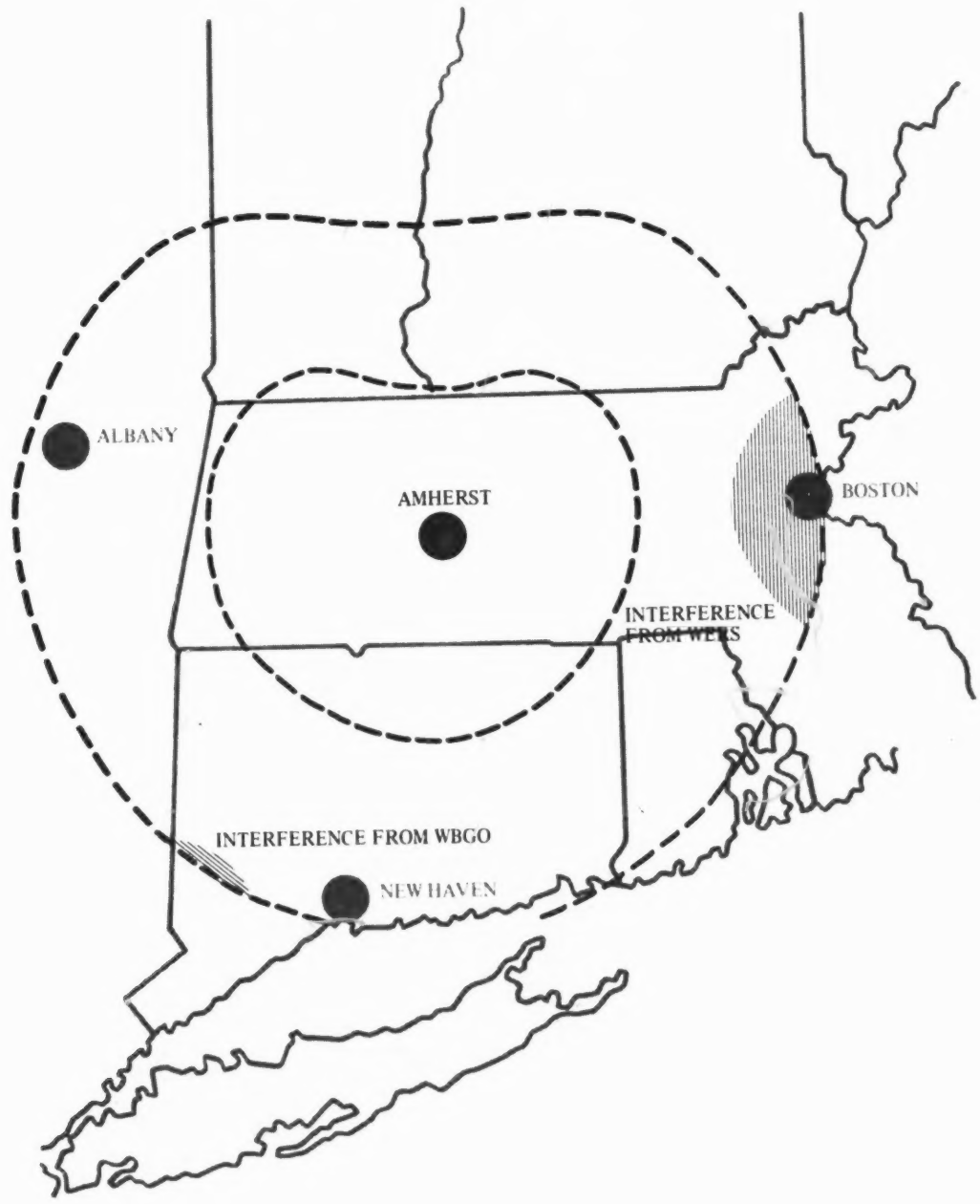
Seven rooms in the School of Education, ten rooms in Bartlett Hall, twelve rooms in the elementary school, and eight in the high school will be wired to the system being developed by the School of Education. The present system includes a coaxial cable to the elementary school and a two-way telephone cable to the high schools in the area. Microwave is not used in the system but there is a possibility it might be used at Bartlett Hall on the main campus. Another possibility would be to connect to a private cable company which would cause Channel 13 to be used as a school channel. The arrangement would make it possible for programs to be received in homes in the Amherst area as well as in the school. About thirty receivers are located in the schools and ten monitors located in the television origination areas. Television projection is not used at the present time.

The reception of these programs is limited to those schools that are currently part of the closed circuit system. There is no mobile unit but miniature broadcast units have been proposed and will probably be available in the near future.

Many of the classrooms in the system could be used as origination areas in addition to the single studios in Bartlett Hall and the School of Education. Two Dage professional vidicon cameras are now in use and eight small video tape recorders are available for use with the system. A film chain is being assembled with the Dage vidicon camera and 16mm slide capability .

There are no broadcast facilities at the University of Mass-

Figure 4: WFCR Five College Radio Network



achusetts but Channel 57 and a campus television center may be developed within the next five years.

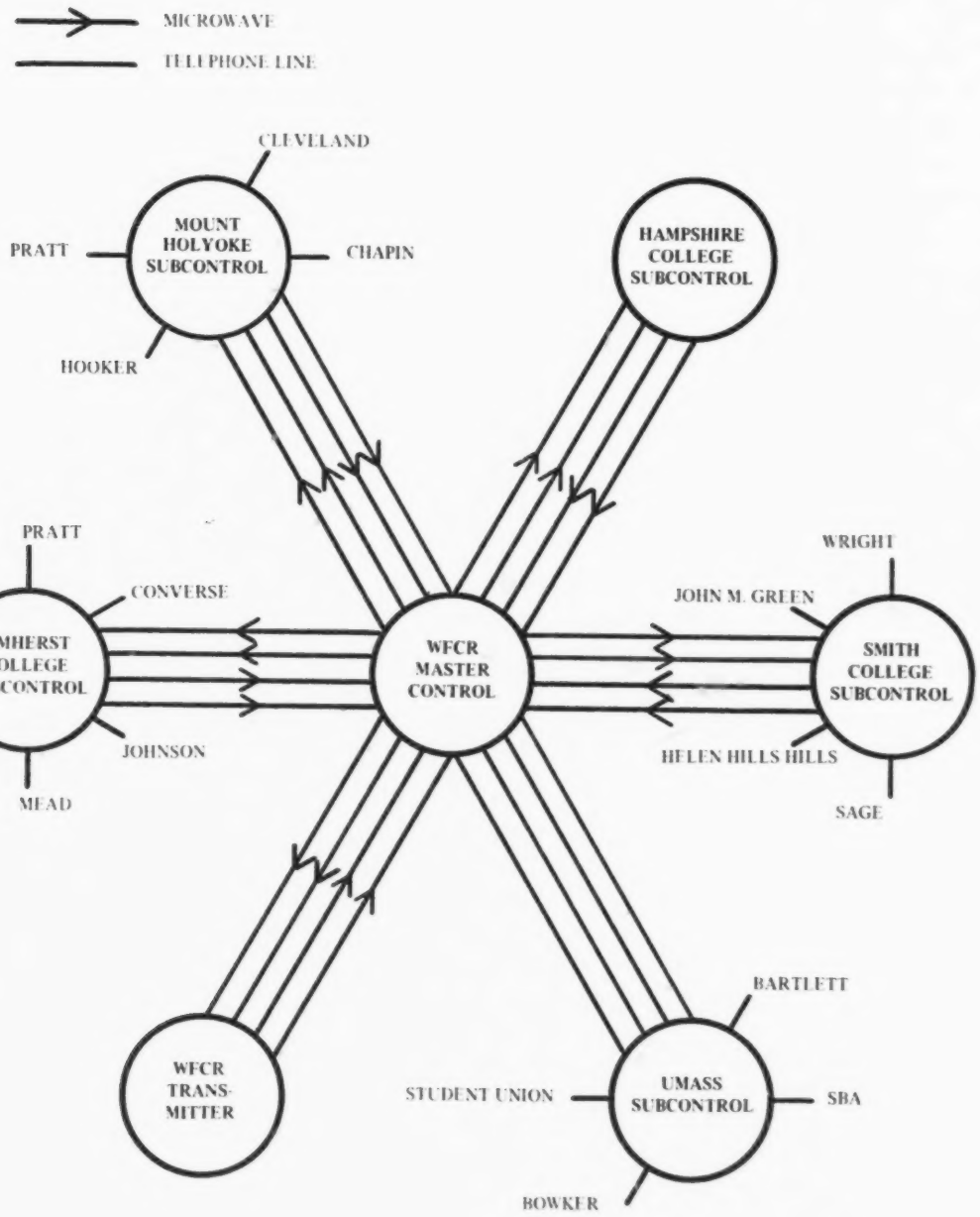
FM Radio Facilities

WFCR-FM is the University station, and WMUA-FM is the student station. The University station broadcasts on 34,000 ERP and the student station broadcasts on ten watts. WFCR operates on 88.5 megacycles and WMUA on 91.1 megacycles. WFCR has a full-time station manager, three full-time engineers, a program director, a production manager, a secretary for continuity, and twenty part-time assistants. Ten students work for five hours a week and receive one credit in Speech. The University station receives support from University appropriations, contributions from listeners and sponsors or underwriters. It operates on a budget of approximately $90,000 a year. The person interviewed was Mr. Albert Hulsen who is the station manager.

WFCR is the most highly developed radio station among the land-grant institutions and is an example of the advantages of network operation. It is shared by four other institutions in the Amherst area who contribute to its financial support and programming. The bulk of the programming support comes from the University of Massachusetts, but it is a true network operation which shares programming with the Albany and Boston educational radio stations. Program switching can be done in Hampshire House where the facilities are located. The facilities include two studios, an announce booth, and two control rooms. Offices include maintenance, library, and related support spaces.

These services and facilities are shared by the broadcast council which is composed of members from Mount Holyoke, Smith, Hampshire, and Amherst Colleges, and the University of Massachusetts. The Eastern Educational Radio Network includes WFCR in Amherst, WGBH in Boston, and WAMC in Albany. An outstanding schedule of educational radio programs is broadcast from this location and the signal is widely received throughout Massachusetts and bordering states. This station could well provide the leadership for developing a New England Educational Radio Network which would help serve the needs of continuing education in the region. It could probably be done at reasonable cost if each of the contributing institutions were to upgrade their own programs to make meaningful contributions to the network operation and reach appropriate audiences within the states in which they are licensed.

Figure 5: Five College Radio Interconnection



University of Vermont

Computer Facilities

David B. Hill, Assistant Professor of Mathematics and Community Medicine, is the Director. He has a full-time associate director who is responsible for the management of systems, an operations manager, a systems programmer, an applications program manager, three graduate assistants, and several machine operators.

In December 1967 an IBM 360 model 30 with 64,000 core storage, two card readers, and two printers was added. Peripheral storage includes three disc and four tape machines. There is no drum, but a data cell is under consideration for a medical systems project. Current space is inadequate but additional space will result from the renovation of a wing in Waterman Hall where the computer center in now located. Six remote terminals are in operation in engineering, in Waterman Hall and in the Medical College; they are connected by telephone lines. Other institutions could use this facility through remote stations. The present computer can accommodate 31 stations simultaneously. They are also exploring the possibility of using a large computer at McGill University to relieve potential peak-load situations. The acquisition of a model 40 in 1968 is the most recent addition to the equipment.

There is an additional computation facility in the Medical College with high speed response for on-line psychological measurement. It will be operated by the major computation center and will be located in that facility.

Educational Media and Instructional Materials Facilities

Dr. Robert Sekerak, Director. The Audio-Visual Center at the University of Vermont is under the administration of the Dean of the College of Education for those matters that are related to teaching responsibility. Half time is devoted to the administrative affairs of the Audio-Visual Center and that responsibility was temporarily under the direction of the President.

A film library of 2,000 prints provides films on a rental basis to the state of Vermont and neighboring states. The films are distributed free on the campus and in the State Department of Education. Rental charges are applied for films rented off the campus and a film catalog is available.

The department has an inventory of audio-visual equipment which is supplied on a long-term loan to the departments and repaired on the campus. It is required that other departments

consult with the audio-visual director on purchases of audio-visual equipment.

The Division of Health Sciences has created a Department of Instructional resources for the Medical School. This includes facilities for electronic, graphic, and photographic production. An information retrieval center to serve faculty and students is also under consideration.

There are three photo agencies on campus so the Audio-Visual Center does practically no still picture photography. Some 16mm photography is done in conjunction with the medical school and physical education departments. There is also some 8mm film production in the Audio-Visual Center. Students now work with the faculty members in the area of film production but the program will eventually be taken over by the graphics department.

The relationship to the campus television services is presently under discussion. The Audio-Visual Center loans portable television equipment to several agencies and the physical education department has a portable closed-circuit system. The State Educational Television Service is licensed and owned by the University and the Audio-Visual Center participated in the in-service and preservice training of teachers who use this medium.

A learning center is currently being planned on the campus and there are long range plans for every residence hall to have TV viewing. There is also a plan to have all classrooms wired with TV outlets. The learning center will be located in Waterman Hall and will have some remote access units in carrels for use by students.

Library Facilities

Paul Kebabian, Librarian. Mrs. Helen Oustinoff, Assistant Librarian, is involved with computer cataloging. The cataloging department is currently using the teletypwriters. There is no co-ordinator of non-book materials and no materials other than books are circulated by this library. The book holdings include approximately 420,000 volumes.

There are no non-book materials, no projection facilities, no projection equipment, and no audio equipment available in this library. The building is not wired to receive or send television signals. The library does have an off-line teletype connection to Maynard but no line to the computer on campus. A TWX system is used in the medical library. Students may eventually have access to a computer-produced book catalog as a by-product of

the NELINET program.

No plans have been made to provide remote access to a computer for study carrels in the library. Special facilities include the music listening rooms in the music library, a separate facility.

Construction of new facilities, now in the planning stages, will probably start in 1970 and be two years in construction. The nature of these facilities is relatively vague at this time so it is difficult to indicate whether expanded media facilities would be available in the new addition.

George Hunter, Medical Librarian, has instituted a reprint service which provides information upon request. The emphasis is on periodical articles. A TWX system also serves the patrons of the medical library which has recently moved into completely new facilities which have spaces for the use of audio-visual resources.

Television Facilities

Dean Raymond Phillips, Director. An extensive educational television network became fully operational in 1968. A full-time staff of engineers and producers has been assembled to support a new broadcast studio which is a complete educational broadcasting facility.

A closed-circuit television system on the campus permits programs to be originated or received within the buildings that are interconnected. In addition, there are rooms interconnected within a single building and the de Goesbriant Hospital is connected to the Mary Fletcher Hospital. Serious consideration is being given to the development of a two-way medical network which will permit a variety of activities between several points to support continuing medical education, including diagnostic x-ray work. At the present time the University of Vermont is not connected with any other institution with the exception of Mary Fletcher Hospital. The ETV studios are located six miles from Burlington at the Ethan Allen campus. Equipment includes a mobile unit and they distribute through telephone cables.

There is an extensive microwave system which links Maine, New Hampshire, and Vermont with Massachusetts and the potential is being developed for a broad-band two-way system in the future. A few viewing monitors are located in the Audio-Visual Center, Waterman Hall, the Medical School, and other areas. All dormitory rooms can receive television signals off-air and this is also true of student lounges. Two studios located in the building

at Fort Ethan Allen have recently been constructed. There are no production areas other than TV studios, but the AV facilities in the Medical School will have spaces for television production.

Radio Facilities

WRUV-FM, broadcasting on 90.1 megacycles, is a ten-watt station. The studios are located in Pomeroy Hall but will be moved when the Fine Arts Center is completed in 1970-71. This is a student-owned and operated radio station. University funds are used to support the program through the Speech Department which provides advisory and supervisory activity. The station is licensed to the University. Interviews were conducted with Dr. Norman London and Mr. Marvin Bensmen, the station manager.

This station has a full-time station manager and is supervised by the Department of Speech. An application for an effective broadcast radius will conflict with the Canadian border. At the present time there is one studio, one control room, and a certain amount of new equipment. Extensive new facilities are planned for the Fine Arts Center. Assuming the usual attrition of space requests due to increases in construction costs and design problems, this facility will still be one of the finest radio facilities among the New England land-grant colleges. Because of the problems of increasing broadcast power, it is conceivable that the station could profit greatly from a linkage which would permit the programming to be carried by microwave or cable to other sections of the state for rebroadcast where there would be no conflict with the Canadian border.

University of Rhode Island

Computer Facilities

William Hemmerle, Director. An extensive support staff includes seven full-time people and three or four part-time people, who devote about 35 percent of their time to instruction. Equipment includes an IBM 360 Model 40 and peripheral storage includes three discs, storage drives and four magnetic tape units. A Model 50 will be added in November and about sixteen remote consoles will be added at that time. More office and machine space is badly needed but there are no specific plans for such space at the present time.

The computer is available on a time-sharing basis using remote slow speed stations, a number of display consoles in the computer lab, and typewriter consoles. At the time of this inter-

view there were approximately four display stations and five typewriter consoles which are located in the computer laboratory, the Graduate School of Oceanography, the College of Engineering, the Department of Electrical Engineering, and the College of Business Administration. Leased telephone lines connect the oceanography facilities but the others are connected directly through the campus system. There has been an active effort to involve local and public school systems in the use of remote terminals. A large number of remote terminals could be operated simultaneously with a current capability of eight display stations and fifteen teletypwriters. A time-sharing program is in operation but the equipment does not include an audio response unit for telephone queries.

Additional facilities include a 1510 for administrative work which is located in Lippit Hall. It has a 20 K memory and seven tape systems for peripheral storage. Additional computation facilities will be under the supervision of Dr. Dayler at the Oceanographic Center. He is heavily involved with retrieval and distribution of information and has done a great deal of work in the cataloging of research information in marine science.

Educational Media and Instructional Materials Facilities

Dr. Rowland G. Cresser is Director of the Audiovisual Services Center and Assistant Professor of Education. Peter Hicks, Supervisor of Audiovisual Services, reports to Dr. Cresser, who reports directly to the Vice President for Academic Affairs. The staff includes two technicians and a graphic artist.

A small film library handles approximately 1,000 requests for films per year, both on and off the campus. A catalog of films is available and there is no charge for the service.

This department supplies most of the audio-visual equipment used on the campus and it maintains a central equipment pool for faculty use. The technicians do most of the repair work because of poor dealer service in the area.

Extension courses provide the major link to the Division of Continuing Education. Campus facilities that include unique applications of educational media are planned for the facilities at the Oceanographic Center. Remote computer terminals and remote access by teletypewriters in the library are the most significant campus information links now under development.

Library Facilities

Francis P. Allen, Librarian. Abner Gaines, Associate Librar-

ian, and Natalie Wood, Head Cataloger, are closely associated with the NELINET project. This library does not have a coordinator of non-book materials because of the separate audio-visual facility on the campus. Microforms do not circulate outside the library but tapes and discs are distributed. The book holdings are 250,000 and the non-book materials would consist of approximately 1,000 recordings, which are mainly recreational. The library does not distribute flat pictures, slides, or paintings.

There are no facilities or equipment for the projection of visual materials. Recordings can be used at a single station with four headsets which enable the people to listen to one disc at a time. The building is not wired for television, so there has been no reception or origination from that point.

This library is involved in two basic types of linkage projects. The first is the NELINET project with the six state universities and the second is a teletype network which has been established in the state of Rhode Island. Teletypewriters are used for input-output equipment.

The current building was opened in 1964 and no expansion projects are under consideration that will provide any special facilities. An addition will be built in the future but plans are not firm. A library is under construction at the Oceanographic Center which is at the Bay Laboratories. The Graduate School of Oceanography is planning interconnections with Woods Hole and other institutions in New England. Stuart Hale and Theodore Smayda are coordinating this program which is the major library linkage program currently under consideration in Rhode Island.

Educational Television Facilities

A newly created office for photography, radio, and television (PRT) is headed by James H. Goff, Radio and Television Officer. He reports to James W. Leslie, the Director of Public Relations. University photography is part of the PRT operation as is television film production which employs two full-time cinematographers, plus a freelance script writer.

The center is producing gerontology and fisheries films with grants under Title I of the Higher Education Act. The films are intended for both TV and AV audiences.

The state television station is located in facilities at Rhode Island College in Providence. There are no links between Providence and the University of Rhode Island. The only television installation on the Kingston campus is a closed circuit system

designed to satisfy the requirements of that campus. A satellite production center has been proposed at Kingston, but no action has been taken. Several of the buildings on campus are wired for television but none are interconnected. All new buildings will be wired in the future.

There is a microwave link between the electrical engineering building and Raytheon Corporation in Portsmouth, R.I. The purpose of the link is to permit professors in Electrical Engineering at the University conduct classes for Raytheon employees and teachers who are located across Narragansett Bay in Portsmouth.

The eight megacycle microwave facility between Kingston and Portsmouth was installed by Raytheon Corporation. It has a one-way video channel and a two-way audio system. There is no state-owned microwave television system in Rhode Island.

Monitors are located in many of the classroom buildings and additional monitors have been purchased during the past year. There are two projection TV systems in Green Hall and another system is being developed at the Marine Science facility at the Bay Laboratories. Several large group areas in Green Hall and Edward Hall can accommodate many students for televiewing. It is possible to receive TV on the Bay Campus, the College of Pharmacy, and in the College of Engineering. Several classrooms are interconnected in Independence Hall and there is an audio-visual classroom in Green Hall that was designed specifically for televiewing. Students do not receive television in lounges or individual study carrels, but commercial television can be received in the dormitories. A classroom studio in the electrical engineering building serves the needs of the Raytheon system and a studio and a control room are used for programs which are taped for use on the campus. Several of the classrooms at the Bay Campus are also suitable for origination. Two vidicon cameras are used in the studios and one in Electrical Engineering. Video tape recorders are located in both areas.

FM Radio Facilities

James H. Goff was interviewed. WRUI-FM, operating in 91.1 megacycles, is a ten-watt FM station that includes a closed circuit AM system operating on 560 kilocycles. The station is licensed to the Board of Trustees, is located in the Memorial Union, and has two studios, one AM and one FM. It is operated by a student manager with an advisory board and its revenue is from student fees. There are no immediate plans to increase the power.

University of Connecticut

Computer Facilities

John Lof, Director. An Assistant Director's position was vacant. There are four programmer positions, eight graduate assistants, and several undergraduate students who work in the Center.

The equipment is an IBM 360 Model 65 acquired in September of 1967, an IBM 1620 and a large analog computer which is a 231-R of Electronic Associates, Inc. The IBM 360/65 has 512K bites of main storage, and peripheral storage includes five 2311 disks of seven million bites each, four tape drives in 2402 dual units, and one 2301 drum of four million bites. Current space is barely adequate but plans for a large facility in a Mathematical Sciences Building are on the building schedule for occupancy in 1973. The present computer systems operate primarily in the batch mode and process around eight to nine thousand research and educational jobs a month. Twenty or more remote terminals are in operation and at least one is located in each of the five branches of the University. Terminals will be used both for education and for research and it is expected that there will be one or more terminals per academic building with six in the Computer Center. INWATS lines connect the branches and direct lines are used on the campus.

There are plans to encourage other educational institutions in the state to use the facility through remote terminals since it can operate 30 simultaneously with expansion to 60 in two to three years. Plans call for equipment additions in January 1969, of a one million bite Large Core Storage and a 200 million bite 2314 Direct Access Storage Disk facility. Much of the time-sharing capability is supported by a new National Science Foundation grant.

Additional computer equipment is available on the campus in three other areas. The Electrical Engineering Department has both a PDP-5 and PDP-9 for research and educational programs. The School of Business Administration will replace an IBM 1401 with a 1130 to carry out information retrieval work of its NASA information center. The Data Processing Center has a new IBM 360 Model 30 for the administrative functions of the University. None of these facilities have any direct relationship to the equipment used in the Computer Center. The staff is exploring the

possibility of developing a grant proposal to create a local time-sharing center and to take some of the responsibility from MIT which is now bearing the brunt of this program.

Educational Media and Instructional Materials Facilities

Carleton Erickson, Director. His staff includes four assistant directors and four full-time technicians who assist with the conduct of the program at Storrs. He is administratively responsible to the Dean of the School of Education. Budget support is through the School of Education and through income from the film rental library. The graduate program is under the School of Education and undergraduate courses are taught for pre-service teachers.

The University has a film library of 2,500 prints which are distributed free on the campus and are rented to off-campus users, primarily in the state of Connecticut. A film catalog is available.

Most of the audio-visual equipment on the campus is supplied by the Audio-Visual Center which maintains a central pool. The director of the center consults on purchases for other departments and the staff repairs equipment for the campus.

Some 2 x 2 slides are produced by the graphic unit but non-instructional photography is the responsibility of a separate photo lab on campus. Student films are the only type of 16mm film production that is done at the center and a few 8mm films are produced. Two staff members and two students participate in the film production, but not on a full time basis. The film production unit is now under development but there are no special facilities for this purpose at the present time.

Graphic services are supplied to the faculty and the emphasis is on slides, tapes, and transparencies. Two full-time staff members and two students are responsible for this program. Special facilities include graphic labs for both teaching and production. The campus television services are separate from the audio-visual center but every branch of the campus is cable-connected by a telephone connection with a two-way talk system.

There is a close relationship to the Division of Continuing Education and many special services are provided, in addition to the extension courses which are taught by the staff. Unique educational facilities include a foreign language lab and a music lab with remote control features. At the present time there are no firm plans for campus facilities that would link various information sources for remote access by faculty and students.

Library Facilities

John P. McDonald, Director of Libraries, has been serving as the representative of the University of Connecticut with NELINET. The head cataloger and the reference librarian have also been involved in the project. There is no director of non-book materials but the reference department is responsible for the microforms and special collections which do not circulate outside of the library.

As of June 1968 there were 710,375 volumes in the library, not including microforms. There are a small number of tapes and plans for an oral history project which will expand the tape collection. The discs are in the music library and are controlled by that department. This facility does not have flat pictures or slides, but the Art Department does have an extensive slide collection. The reference department has a vertical file of such things but it is not very extensive.

There are no facilities for the projection of visual materials and any equipment that is used for this purpose is obtained from the audio-visual center. An audio listening facility consists of four stations that will accommodate tape recorders to record "listening books" for the blind. This is an unique program that is being expanded at this institution. There are no other tape or disc recording stations and no dials, carrels, or listening rooms.

The building is wired to receive TV but it has no master antenna. Most of the receiving is in small groups and is usually closed circuit programming. No programs are originated in the library.

An extensive use of computer terminals on the campus indicates that Connecticut will again exert leadership in this direction. Most of the interconnections have been stimulated by the computer center and the library is involved in two systems. The first system is the NELINET project and the second is an extensive TWX system throughout the state of Connecticut. At this point the University is a contributor to the TWX system with a heavy demand on the reserves of Brown University. The input-output is TWX, TWP, and data phone. There are long-range plans for a graduate research library and the old building probably would be converted to an undergraduate facility. This planning is incomplete at this time and it is impossible to indicate what kinds of unusual facilities might be available when the new building is developed.

Educational Television Facilities

Stanley J. Quinn, Director. He has four producer-directors, one chief engineer, and two assistant engineering students on a co-operative program from Northeastern, with one maintenance engineer to be added.

There are extensive interconnections between buildings and between the branches of the University, as well as mobile equipment. An extensive micro-wave network was developed by Western Electric and is leased from the Southern New England Telephone Company to connect all of the branches throughout Connecticut. This system permits audio responses from the students viewing television. It has eight megacycles bandwidth and is a one-way distribution system. The student response is on an audio frequency through an arrangement with the telephone company. Approximately 40 monitors are used on the campus of the University of Connecticut and TV projection is used occasionally. Reception is possible in many areas including large group areas and classrooms. No rooms are specifically designed for televiewing and there is no reception in dormitory rooms.

One studio is linked to WTIC, a commercial station in Hartford, by a microwave link. The technical quality of the signal is not adequate to carry programs that originate in the studio at the University. For this reason, programs developed by the Radio-TV Center for open circuit broadcast are produced at the broadcasting stations (WTIC Hartford and WNHC New Haven). Four vidicon cameras, two Ampex and four Sony video tape systems, and a film chain are located in the University studio for local production.

In summary, the studio facilities at the University support programming which is transmitted through Southern New England Telephone Company micro-wave system to all of the branches of the University. Any broadcast activity is conducted through the commercial stations located in Hartford and New Haven.

Radio Facilities

Stanley J. Quinn, Director. WHUS-FM, operating at 90.5 megacycles, is a ten-watt station. It is a student-operated and financed station with plans to increase to 1,000 watts in the future. There is no professional staff and it is operated entirely by students. Mr. Quinn is responsible for coordinating educational radio programming for the University and at the present time his

efforts are confined to the distribution of tapes to commercial stations for broadcast. Some of the radio programs developed at the Radio-TV Center are carried by WHUS-FM. Increase in power will permit Connecticut to increase its effective broadcast area and may result in increased financial support.

Appendix

EEN Associated Institutions

Educational Institutions

Albany Institute of History and Art
American University
Bates College
Bennington College
Boston College
Boston University
Bowdoin College
Brandeis University
Brookings Institution
Canisius College
Carnegie Institute of Technology
Catholic University of America
Chatham College
Chautauqua Institute
Colby College
Columbia University
University of Connecticut
Dartmouth College
University of Delaware
Duquesne University
D'Youville College
Franklin Institute
George Washington University
Georgetown University
Glassboro College
University of Hartford
Harvard University
Howard University
Keene State College
Lowell Institute
University of Maine
University of Maryland
Massachusetts Institute of Technology
Mellon Institute
Mt. Mercy College
University of New Hampshire
Niagara University
New York University
Northeastern University
University of Pennsylvania
University of Pittsburgh
Plymouth State College
Institute at Rensselaerville
Rensselaer Polytechnic Institute
Rivier College
Rosary Hill College
Rutgers, The State University
Shady Side Academy
Simmons College
Skidmore College
St. Anselm's College
St. Joseph College

State University College at Buffalo
State University of New York
Temple University
Trinity College
Tufts University
Union University
Villanova University
Yale University

Cultural Institutions

Albright-Knox Art Gallery
American Museum - Hayden Planetarium
Boston Symphony Orchestra
Buffalo Historical Society
Buffalo Philharmonic Orchestra
Buffalo Science Museum
Carnegie Museum and Library
Corcoran Gallery of Art
Folger-Shakespeare Library
Soloman R. Guggenheim Museum
Philadelphia Grand Opera Company
Philadelphia Museum of Art
Philadelphia Orchestra
Phillips Gallery
Pittsburgh Symphony
Smithsonian Institution
Washington Opera Society
Hagley Museum, Wilmington
Hartford Symphony Orchestra
Institute of Contemporary Arts, Washington
Library of Congress
Lincoln Center for the Performing Arts
Metropolitan Museum of Art
Museum of Fine Arts, Boston
Museum of Science, Boston
National Gallery of Art
National Symphony Orchestra
New England Conservatory of Music

Higher Education Act, Title VIII: Networks for Knowledge Sharing Educational and Related Resources

Sec. 801. (a) To encourage colleges and universities to share to an optimal extent, through cooperative arrangements, their technical and other educational and administrative facilities and resources in order to test and demonstrate the effectiveness and efficiency of a variety of such arrangements, the Commissioner is authorized to enter into contracts and to make project grants for all or part of the cost of planning, developing, or carrying out such arrangements. Such grants may be made to public or non-profit private colleges or universities. When in the Commissioner's judgement it will more effectively promote the purposes of this title, the Commissioner may make grants to other established public or non-profit private agencies or organizations, including professional organizations, or academic societies and he may enter into contracts with established private agencies or organizations.

(b) Projects for the planning, development, or carrying out of such arrangements assisted under this title may, subject to the provisions of subsection (c), include —

(1) (A) joint use of facilities such as classrooms, libraries, or laboratories, including joint use of necessary books, materials, and equipment; or interinstitutional catalogs and through development of systems and preparations of suitable media for electronic or other rapid transmission of materials;

(2) establishment and joint operation of closed-circuit television or equivalent transmission facilities (such as the instructional television fixed services); and

(3) establishment and joint operation of electronic computer networks and programs therefore, to be available to participating institutions for such purposes as financial and student records, student course work, or transmission of library materials.

(c) (1) Grants pursuant to clause (B) of paragraph (1) of subsection (b) may not be used to pay the costs of electronic transmission terminals.

(2) In the case of a project for the establishment and operation of a computer network, grants may not include —

(A) the cost of operating administrative terminals or student terminals at participating institutions; or

(B) the cost, or any participating institutions' pro rata share of the cost, of using the central computer facilities of the network,

except (i) such costs of systems development and programing of computers and transmission costs as are necessary to make the network operational, (ii) the administrative and program support costs of the central facilities of the network and (iii) the line-access costs incurred by participating institutions.

Sec. 802. There are authorized to be appropriated for the purposes of this title (and planning and related activities in the initial fiscal year for such purpose), $340,000 for the fiscal year ending June 30, 1969, $4,000,000 for the fiscal year ending June 30, 1970, and $15,000,000 for the fiscal year ending June 30, 1971.

Authority for Free or Reduced Rate Communications Interconnection Services

Sec. 803. Nothing in the Communications Act of 1934, as amended, or in any other provision of law shall be construed to prevent United States communication common carriers from rendering, subject to such rules and regulations as the Federal Communications Commission may prescribe, free or reduced rate communications interconnection services for interconnection systems within the purview of this title, whether or not included in a project for which a grant is made under this title.

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